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Finn

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(54) **PRECLEANER SYSTEM**

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F02M 35/08	(2006.01)
F02M 35/10	(2006.01)
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CPC ***F02M 35/0223*** (2013.01); ***B01D 45/16*** (2013.01); ***F02M 35/0215*** (2013.01); ***F02M 35/044*** (2013.01); ***F02M 35/086*** (2013.01); ***F02M 35/10386*** (2013.01); ***F02M 35/10393*** (2013.01); *B01D 46/0005* (2013.01); *B01D 46/525* (2013.01); *B01D 46/527* (2013.01); *B01D 50/002* (2013.01); *F02M 35/0216* (2013.01); *F02M 35/084* (2013.01); *F02M 35/10013* (2013.01)

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See application file for complete search history.

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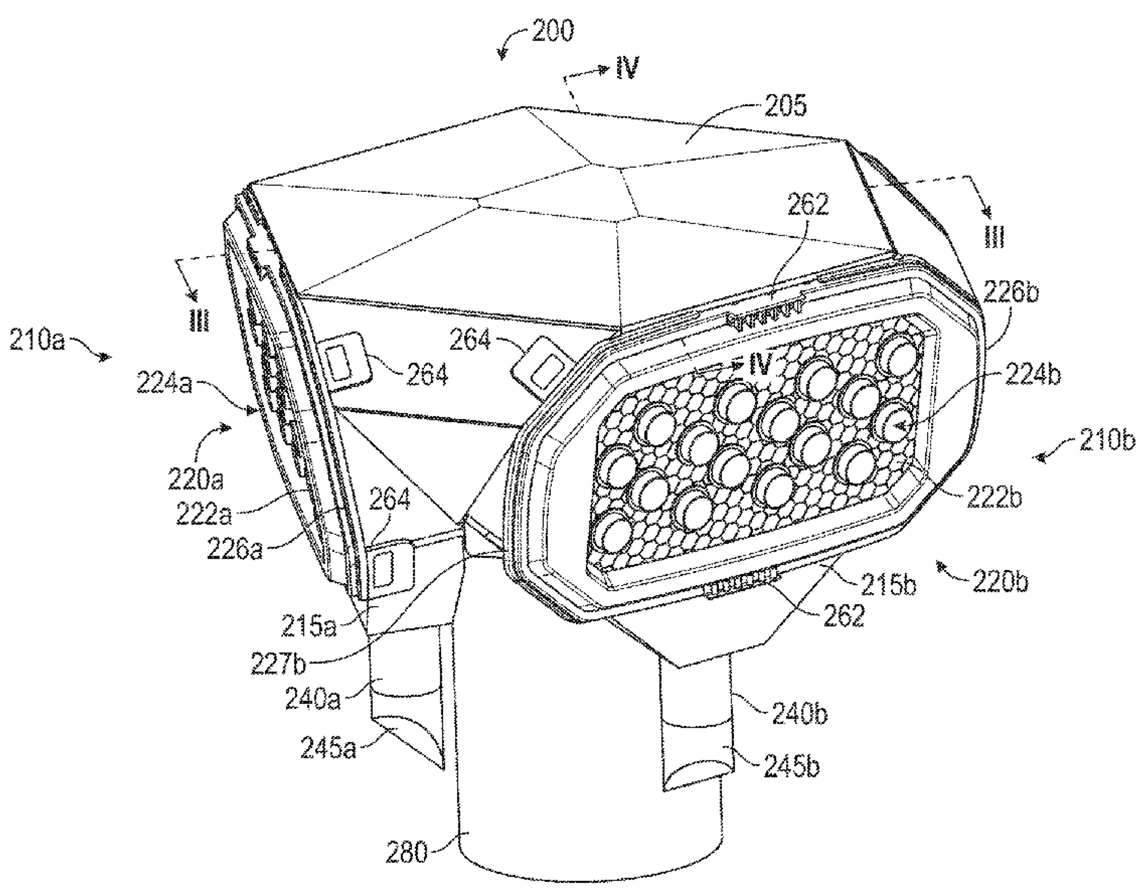
(57) **ABSTRACT**

A precleaner system for an air intake system. The precleaner system includes precleaners each having flow paths that induce a rotation to air flow and separate out particulate matter. The particulate matter is ejected from an outlet port in each of the flow paths and out of a dust ejector. The precleaned air is collected into a plenum from each of the precleaners. The precleaned air can flow from the plenum to a precleaner system outlet and the precleaned air can be received by an air intake system. A cover can be used to block air flow through one of the precleaners to tune the precleaner system to the desired airflow.

16 Claims, 5 Drawing Sheets



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B01D 50/00 (2006.01)
B01D 46/00 (2006.01)

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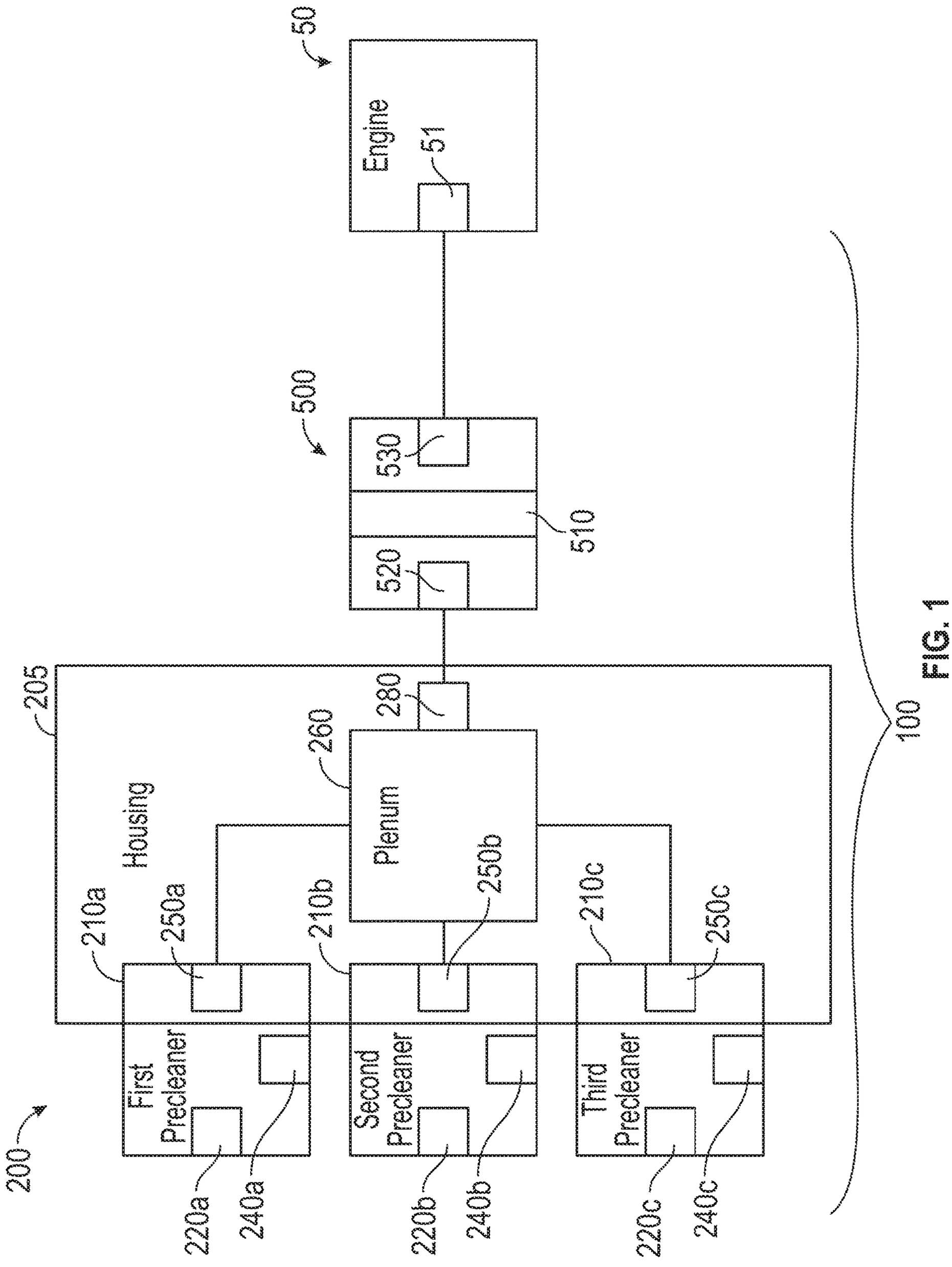
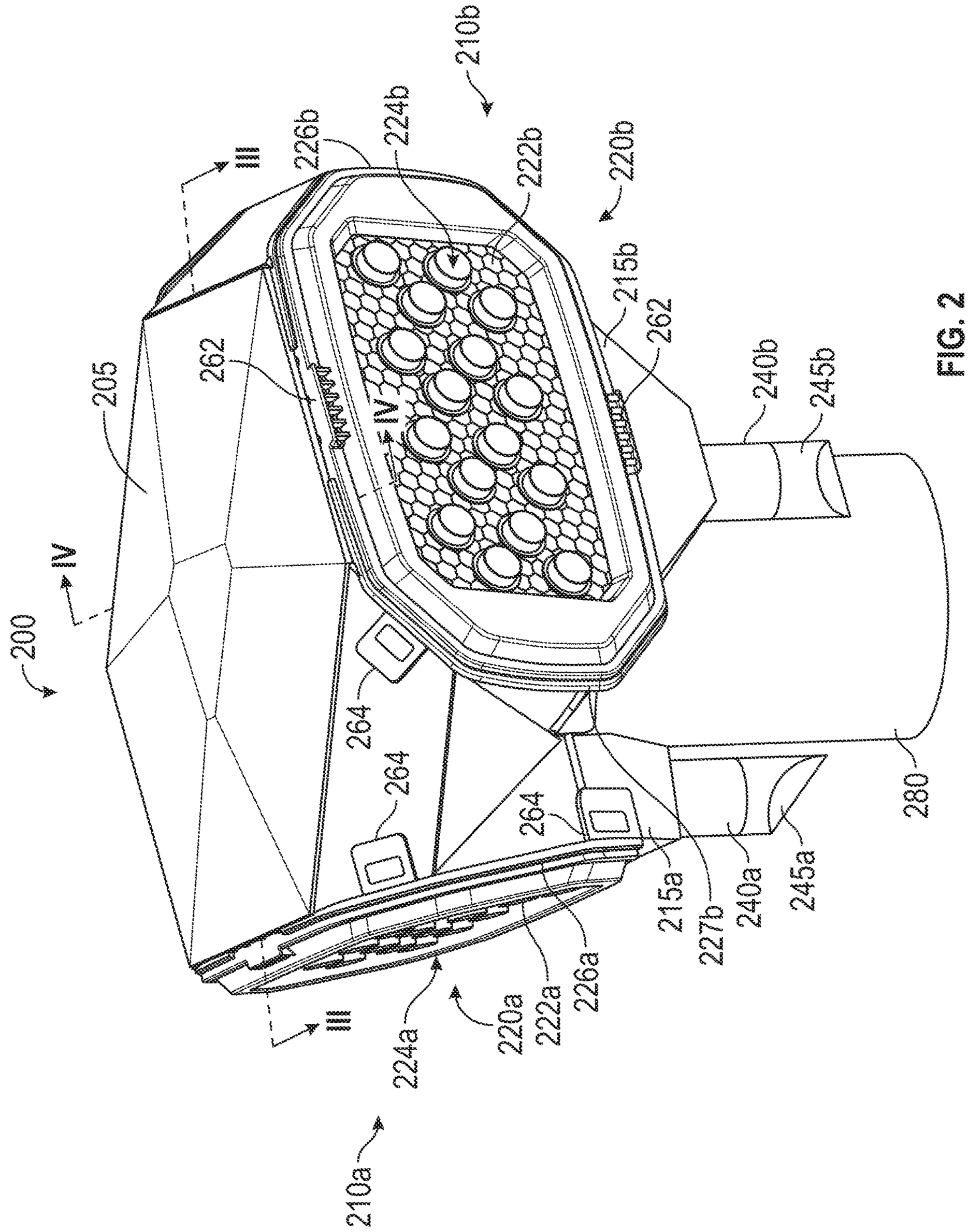

50
Engine
51
500
530
510
520
205
280
260
Housing
Plenum
210a
250a
210b
250b
210c
250c
First Precleaner
Second Precleaner
Third Precleaner
200
220a
240a
220b
240b
220c
240c
100

FIG. 1


210b
226b
224b
222b
220b
III
215b
262
205
262
IV
240b
245b
200
264
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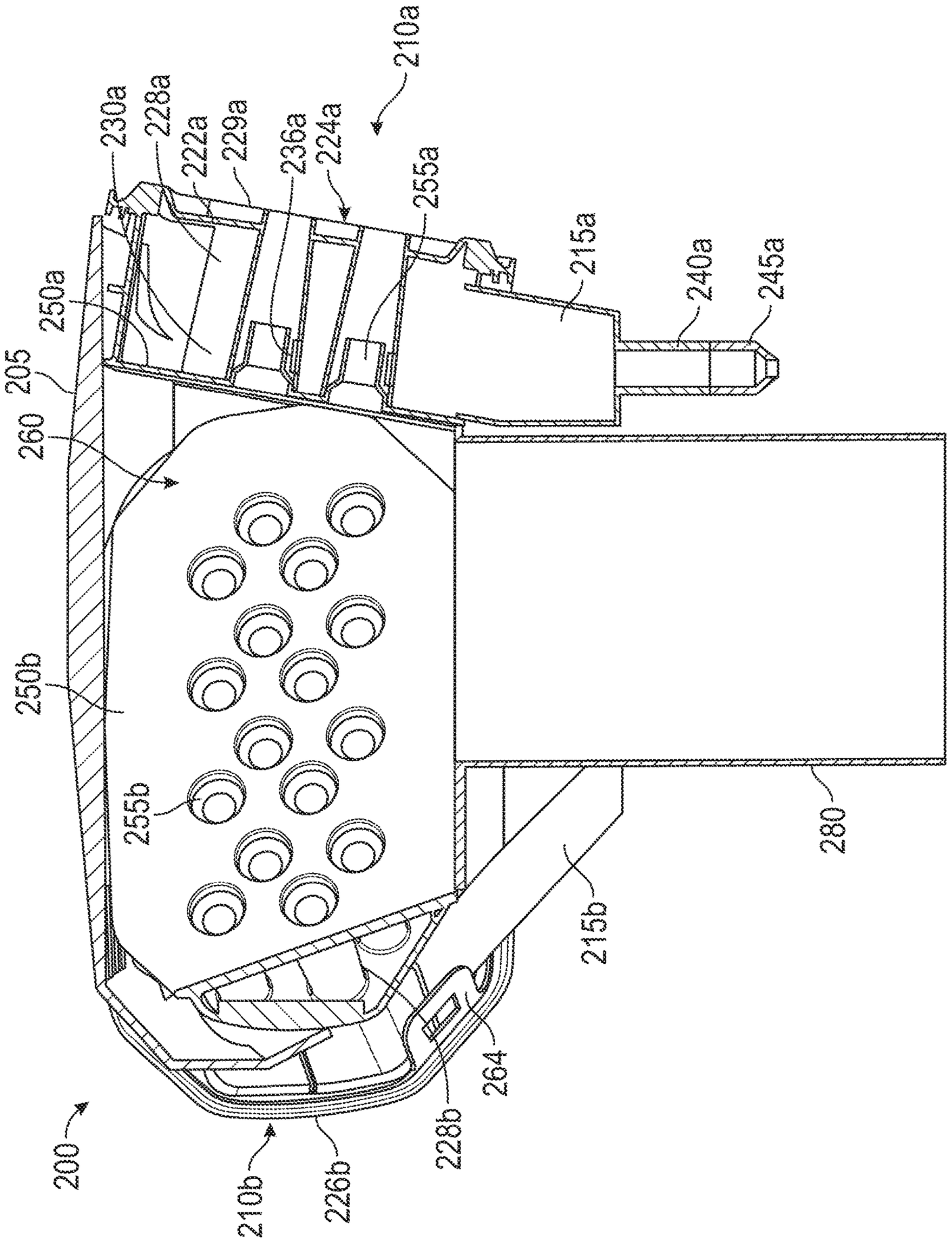
III
224a
220a
222a
226a
210a

FIG. 2


230a
228a
222a
229a
236a
224a
210a
255a
215a
240a
245a
250a
205
260
250b
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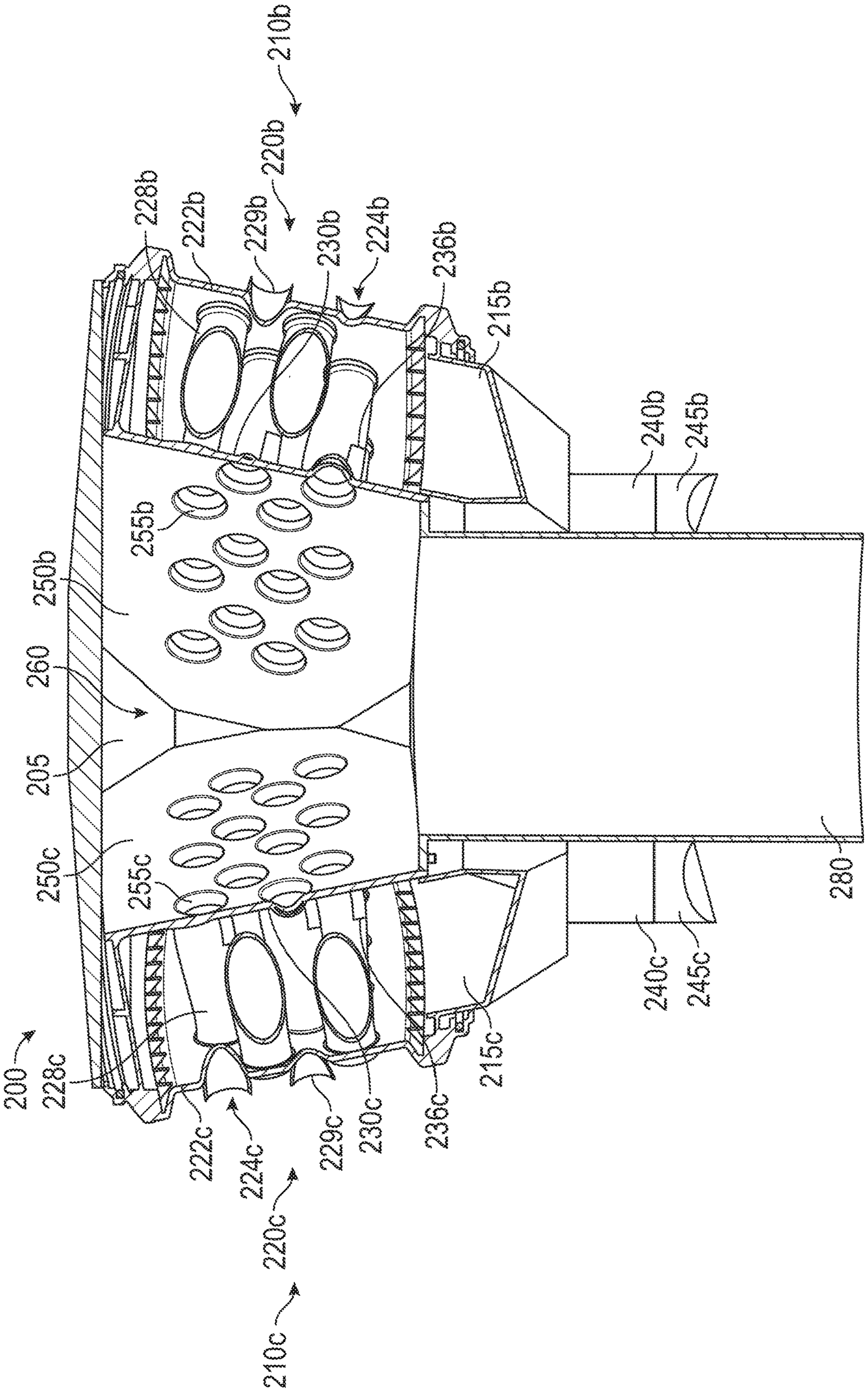
280
215b
264
228b
210b
226b
200

FIG. 3


210b
220b
228b
222b
229b
230b
224b
236b
215b
240b
245b
255b
250b
260
205
250c
255c
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228c
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229c
230c
236c
215c
220c
210c

FIG. 4

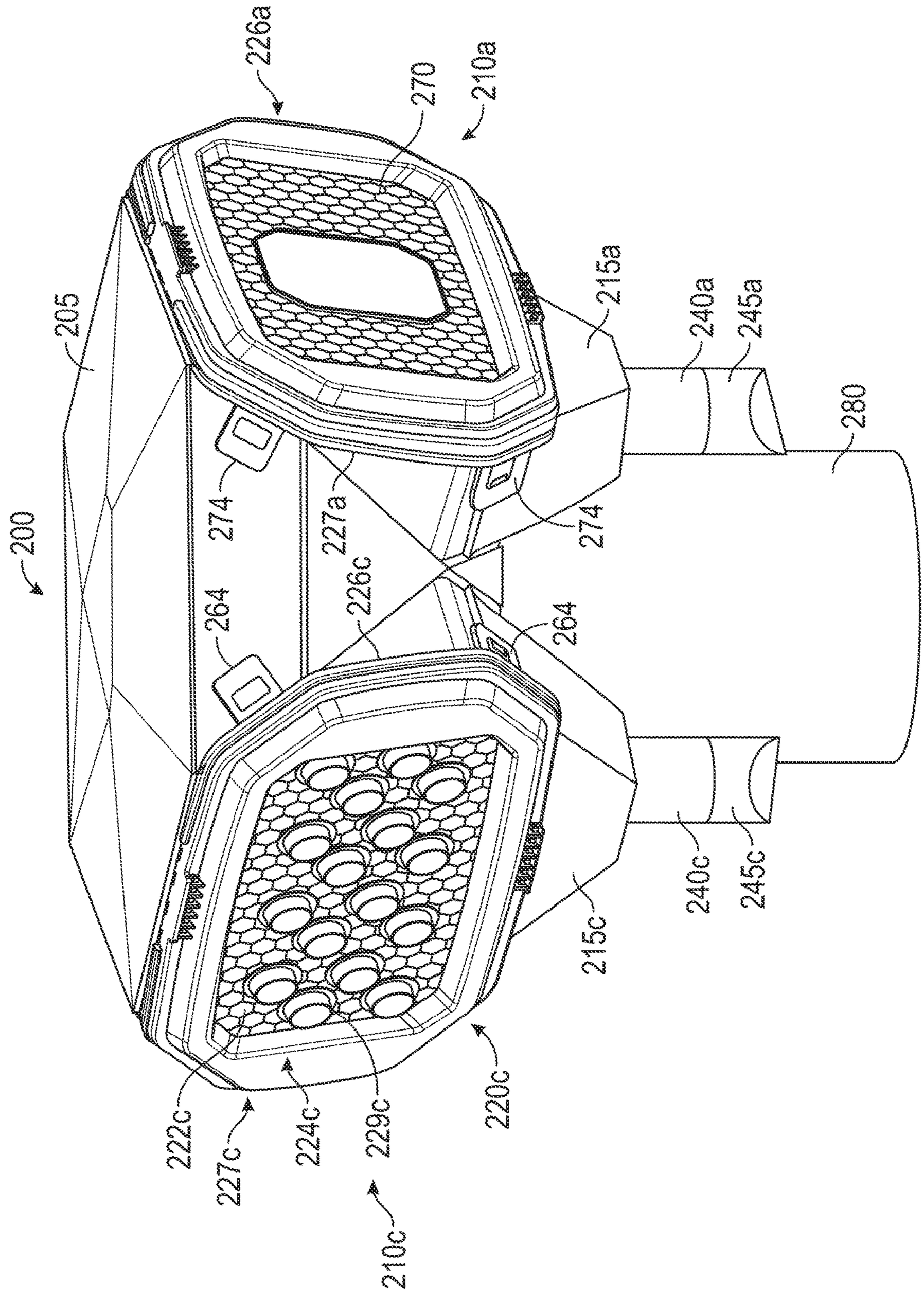
200
205
210a
215a
220a
222a
224a
226a
227a
229a
240a
245a
264
270
274
280
210c
215c
220c
222c
224c
226c
227c
229c
240c
245c

FIG. 5

PRECLEANER SYSTEM

TECHNICAL FIELD

The present disclosure generally pertains to an air cleaner. More particularly this application is directed toward a precleaner system.

BACKGROUND

Currently, there are limited options for external precleaners for use with engine intake air filters that provide desirable efficiency The options that are available typically require use of exhaust scavenging to achieve peak efficiency and are not to meet different airflow speed demands. Exhaust scavenging is inconsistent, costly, and is not always possible due to the proximity of the air filter to the exhaust stack.

U.S. Pat. No. 9,795,907, to Crary describes an adapter assembly that includes an adapter body extending from an adapter inlet to an adapter outlet, a canister mount for securing the adapter body to an air filter canister, and an adapter joint for securing the adapter body to the canister mount. The canister mount includes a collar that is secured about the air filter canister. The adapter joint allows the adapter body to be moved away from the air filter canister for air filter replacement without having to disconnect the adapter body from the air filter canister. Precleaners are airtightly securable to the adapter body inlet, and the air filter canister is airtightly securable to the adapter body outlet. Air cleaned by the precleaners before reaching the air filter has less contamination to be filtered by the air filter before the air flows into an engine.

The present disclosure is directed toward overcoming one or more of the problems discovered by the inventors.

SUMMARY

A precleaner system for precleaning intake air for an air intake system is disclosed herein. The precleaner system includes a plurality of precleaners. Each precleaner includes a precleaner outlet wall. The precleaner outlet wall, and has a plurality of precleaner outlets extending through the precleaner outlet wall. Each precleaner outlet is in fluid communication with the intake air.

The precleaner system further includes a housing, a plenum, and a first cover. The housing extends between each precleaner. The plenum is formed by the housing and each precleaner outlet wall and is in fluid communication with the plurality of precleaner outlets. The first cover is formed to block a plurality of precleaner outlets of at least one of the plurality of precleaners.

BRIEF DESCRIPTION OF THE FIGURES

The details of embodiments of the present disclosure, both as to their structure and operation, may be gleaned in part by study of the accompanying drawings, in which like reference numerals refer to like parts, and in which:

FIG. **1** is a functional block diagram of an example engine with an air intake system with a precleaner system;

FIG. **2** is a perspective view of the exemplary precleaner system of FIG. **1**;

FIG. **3** is a cross section of the precleaner system in FIG. **2** along line III-III;

FIG. **4** is a cross section of the precleaner system in FIG. **2** along line IV-IV; and

FIG. **5** is a perspective view of the exemplary precleaner from FIG. **2** with a cover.

DETAILED DESCRIPTION

The detailed description set forth below, in connection with the accompanying drawings, is intended as a description of various embodiments and is not intended to represent the only embodiments in which the disclosure may be practiced. The detailed description includes specific details for the purpose of providing a thorough understanding of the embodiments. However, it will be apparent that those skilled in the art will be able to understand the disclosure without these specific details. In some instances, well-known structures and components are shown in simplified form for brevity of description. Furthermore, some of the features and surfaces have been left out or exaggerated for clarity and ease of explanation.

FIG. **1** is a block diagram of an example engine with a precleaner. As shown in FIG. **1**, the air intake system **100** may include a precleaner system **200** and an air filter system **500**. The air intake system **100** may be operable for use with an internal combustion engine **50** or any other engine known in the art. The air intake system **100** can receive environmental air (i.e. intake air) and remove particulate matter such as dust, dirt, particulates, water, and other like debris from the intake air, and direct cleaned intake air to the engine **50** for use in the combustion process.

The air intake system **100** can be a two stage system. The first stage can be the precleaner system **200**, upstream of a serviceable primary filter cartridge **510** in the air filter system **500**. The precleaner system **200** can provide for a first stage removal of particulate matter or other contaminates, prior to the air reaching the air filter system **500**. The precleaner system **200** can be an upstream component which operates without passage of the air through media, but rather uses a cyclonic or centrifugal approach to separate particulate matter.

A housing **205** can be formed to contain or encompass various components of the precleaner system **200**. Air to be filtered can enter the precleaner system **200** into a first precleaner **210***a*, a second precleaner **210***b*, and a third precleaner **210***c*, at a first precleaner intake **220***a*, a second precleaner intake **220***b*, and a third precleaner intake **220***c* respectively. Though three precleaners are shown in the figure, fewer or more precleaners can be used. For example, two, four or five precleaners can be used. Particulate matter separated within the precleaners **210***a*, **210***b*, **210***c*, can be ejected through dust ejectors such as a first dust ejector **240***a*, a second dust ejector **240***b*, and a third dust ejector **240***c*, respectively. Air may then pass out of the precleaners **210***a*, **210***b*, and **210***c*, through precleaner outlet walls such as a first precleaner outlet wall **250***a*, a second precleaner outlet wall **250***b*, and a precleaner outlet wall **250***c*, respectively. The air that is passing through the precleaner outlet walls **250***a*, **250***b*, **250***c* may be collected in a plenum **260**, as shown by lines connecting the precleaner outlet walls **250***a*, **250***b*, **250***c* to the plenum **260**. The air may exit the precleaner system **200** from the plenum **260** via a precleaner system outlet **280**. The precleaner system outlet **280** can be in fluid communication with an air passage **520** of the air filter system **500**.

The precleaned air can be received by the air filter system **500** at the air passage **520** and passes through a primary filter cartridge **510** and into a clean air region prior to exiting the

air intake system **100**. The cleaned air can be directed via air passage **530** to downstream equipment, such as an engine intake **51** of the engine **50**.

FIG. **2** is a perspective view of the exemplary precleaner system **200** of FIG. **1**. The precleaner system **200** includes multiple precleaners and can include a first precleaner **210***a* and a second precleaner **210***b*. The precleaners described herein may contain similar features. It is appreciated that the description provided for one precleaner and its components, such as the first precleaner **210***a*, can also apply to the second precleaner **210***b* described and any additional precleaners.

The precleaner system **200** includes the housing **205** and the precleaner system outlet **280**. The precleaning system outlet **280** can extend away from the housing **205** and can be shaped as a hollow cylinder such as an outer surrounding cylindrical wall or tube. The housing **205** can be formed to accept multiple precleaners such as a first precleaner **210***a* and a second precleaner **210***b*, and others not shown. The housing **205** can be formed to receive a portion of the precleaners **210***a*, **210***b* and can position multiple precleaners in a predetermined relationship to each other. The housing **205** can allow multiple precleaners to interact with each other as one precleaner system **200**. The housing **205** can extend from adjacent the precleaners **210***a*, **210***b* and can be partially disposed between the precleaners **210***a*, **210***b*. The precleaners **210***a*, **210***b*, can be disposed at similar heights. The precleaners **210***a*, **210***b*, can each be disposed along an edge of a hexagon formed at the top of the housing **205**. The precleaners **210***a*, **210***b*, can be formed to be removable from the housing **205**.

The first precleaner **210***a* can be disposed outside of the housing **205** and precleaner system outlet **280** and include a first precleaner intake **220***a* for receiving intake air. The first precleaner intake **220***a* can include a first intake wall **222***a*. First flow paths **224***a* can extend through the first intake wall **222***a*. The first precleaner intake **220***a* can be formed to be removed from the first precleaner **210***a*. The first precleaner intake **220***a* can include a clip **264** disposed proximate to the first intake wall **222***a* and formed to connect the first precleaner intake **220***a* to the first precleaner **210***a*. The first precleaner intake **220***a* can include a first intake right side **226***a* disposed to the right side of the first precleaner intake **220***a*. The first precleaner intake **220***a* can include a clip **264** that may be disposed proximate to the first intake right side **226***a*. The first precleaner **210***a* can include multiple clips **264**.

The first precleaner **210***a* can include sixteen first flow paths **224***a*. The first flow paths **224***a* can be evenly spaced from each other and oriented in rows and columns. The first flow paths **224***a* can be in fluid communication with air from the environment. The first flow paths **224***a* can include curved blades or vanes (not shown) to encourage a rotating airflow. The first precleaner **210***a* can include a first duct **215***a* disposed below the first flow paths **224***a* and first intake wall **222***a*. The first duct **215***a* can taper from larger proximate the first flow paths **224***a* to narrower distal the first flow paths **224***a*. The first dust ejector **240***a* can extend from the first duct **215***a* away from the first flow paths **224***a* and the first intake wall **222***a*. The dust ejector **240***a* can be in fluid communication with the first duct **215***a*. The first dust ejector **240***a* can be shaped as a hollow cylinder such as an outer surrounding cylindrical wall or tube. The first dust injector **240***a* can include a first valve **245***a* disposed distal to the first duct **215***a*. The first valve **245***a* can be configured to prevent air from flowing into the first precleaner **210***a* via dust ejector **240***a* and can allow passage of particular matter and moisture out of the first precleaner **210***a*. The first valve **245***a* can comprise a flap valve.

The second precleaner **210***b* can include the second precleaner intake **220***b*, second flow paths **224***b*, a second duct **215***b*, and a second dust ejector **240***b*. The second precleaner intake **220***b* can include a second intake wall **222***b*. The second precleaner intake **220***b* can also include a second intake right side **226***b* and a second intake left side **227***b*. The second intake left side **227***b* can be disposed at the left side of the second precleaner intake **220***b* and the second intake right side **226***b* can be disposed at the right side of the second precleaner intake **220***b*. In other words the second intake right side **226***b* is disposed opposite of the second intake left side **227***b*. The second intake left side **227***b* can be disposed proximate to the first intake right side **226***a*. The second precleaner **210***b* can include clips **264** disposed proximate to the second intake right side **226***b* and the second intake left side **227***b*. The second precleaner **210***b* can include a second valve **245***b*

FIG. **3** is a cross section of the precleaner system of FIG. **2** along plane The first flow paths **224***a* each can include a first passage **228***a* for example, in the form of an outer surrounding cylindrical wall or tube. The first passages **228***a* can each have a first passage inlet **229***a* disposed proximate to the first intake wall **222***a* and a first passage outlet **230***a* disposed opposite of the first passage inlet **229***a*. In other words, the first passage outlet **230***a* can be disposed at the downstream end of the first passage **228***a* and can be proximate to the first precleaner outlet wall **250***a*. In other words the first passage inlet **229***a* will be oriented upstream to the first passage outlet **230***a*. The first passage inlet **229***a* and first passage outlet **230***a* can be in fluid communication with each other. The first passages **228***a* can be tapered from narrower proximate the first passage inlet **229***a* to wider proximate the first passage outlet **230***a*. In other words, the first passage inlet **229***a* can have a smaller diameter than the first passage outlet **230***a*. The first passages **228***a* can also include vanes. The first passages **228***a* can each include at its first passage outlet **230***a* a first outlet port **236***a* oriented in a direction towards the first duct **215***a* and the first dust ejector **240***a*. The first duct **215***a* can be in fluid communication with the first outlet port **236***a*. The first passage inlet **229***a* can be received within the first intake wall **222***a*. The first intake wall **222***a* can include holes sized to receive the first passage inlet **229***a*, for example, in the form of an upstream end of the first flows path **224***a*. The first precleaner outlet wall **250***a* can include a first precleaner outlet **255***a* that extends though the first precleaner outlet wall **250***a* and can extend into or be received within the first passages **228***a*. The precleaner outlet wall **250***a* can be molded as an integral part of the first precleaner **210***a* or as part of the housing **205**. Each of the first passage outlets **230***a* of the first passages **228***a* can be oriented over a corresponding first precleaner outlet **255***a* and be in fluid communication with the corresponding first precleaner outlet **255***a*.

The first intake wall **222***a* can be angled down and may not be parallel with the precleaner system outlet **280**. The first intake wall **222***a* can be parallel with the first precleaner outlet wall **250***a*. The first precleaner outlet wall **250***a* can be angled from vertical and may not be parallel with the precleaner system outlet **280**. In an embodiment, the first precleaner outlet wall **250***a* is integral with and molded with the housing **205**. A lowest point of the first passage inlet **229***a* can be disposed lower than a lowest point of the first passage outlet **230***a*.

The second precleaner outlet wall **250***b* can include a second precleaner outlet **255***b*. In an embodiment, the second precleaner outlet wall **250***b* is integral with and molded with the housing **205**. The second precleaner **210***b* can include clips **264**.

The plenum **260** can be formed by the first precleaner outlet wall **250***a*, the second precleaner outlet wall **250***b*, and the housing **205**. The first precleaner outlet **255***a* and second precleaner outlet **255***b* can be in fluid communication with the plenum **260**. The plenum **260** can be in fluid communication with the precleaner system outlet **280**.

FIG. **4** is a cross section of the precleaner system of FIG. **2** along plane IV-IV. The second flow paths **224***b* can each include a second passage **228***b*. The second passage **228***b* can have a second passage inlet **229***b*, a second passage outlet **230***b*, and a second outlet port **236***b*. The third precleaner **210***c* can include the third precleaner intake **220***c*, a third duct **215***c*, the third dust ejector **240***c*, and a third valve **245***c*. The third precleaner intake **220***c* can include a third intake wall **222***c* and a portion of third flow paths **224***c*. The third flow paths **224***c* can each include a third passage **228***c*. The third passage **228***c* can have a third passage inlet **229***c*, a third passage outlet **230***c*, and a third outlet port **236***c*. The third precleaner **210***c* can include a third precleaner outlet wall **250***c*. The third precleaner outlet wall **250***c* can include a third precleaner outlet **255***c*.

A portion of the third precleaner outlet wall **250***c* can be adjacent to a portion of the second precleaner outlet wall **250***b*. In an embodiment, the third precleaner outlet wall **250***c* is integral with and molded with the housing **205**. The plenum **260** can be formed by the second precleaner outlet wall **250***b*, the third precleaner outlet wall **250***c*, and the housing **205**. The third precleaner outlets **255***c* can be in fluid communication with the plenum **260**.

FIG. **5** is a perspective view of the precleaner system from FIG. **2** with a cover. The precleaner system **200** can include a cover **270** that is formed to cap, restrict, or cover one or more of the precleaner intakes **220***a*, **220***b*, **220***c*. The cover **270** can have clips **274** that can be disposed proximate the top and bottom of the cover **270** and be formed to connect the cover **270** to the precleaners **210***a*, **210***b*, **210***c*. As shown in FIG. **5**, the cover **270** can be disposed over one or more of the precleaner intakes **220***a*, **220***b*, **220***c* and block flow paths **224***a*, **224***b*, **224***c* from environmental air. Covers **270**, can be a first cover and a second cover, and can each block a different intake wall **222***a*, **222***b*, **222***c* and can restrict airflow to one or more of precleaner intakes **220***a*, **220***b*, **220***c* and prevent intake air from entering flow paths **224***a*, **224***b*, **224***c*. The third precleaner intake **220***c* can have a third precleaner intake left side **227***c* and a third intake right side **226***c*. The third intake left side **227***c* can be disposed on the left side of the third precleaner intake **220***c* and the third intake right side **226***c* can be disposed on the right side of the third precleaner intake **220***c*. The first precleaner intake **220***a* can have a first intake left side **227***a* disposed opposite from the first intake right side **226***a*. The first intake left side **227***a* can be disposed proximate to the third intake right side **226***c*.

INDUSTRIAL APPLICABILITY

The present disclosure generally applies to precleaning intake air for air intake systems **100** used with engines **50**. It is understood that the engine **50** may be used with any stationary or mobile machine known in the art. Such machines may be used in construction, farming, mining, power generation, and/or other like applications. Accordingly, such machines may include, for example, excavators, track-type tractors, wheel loaders, on-road vehicles, off-road vehicles, generator sets, motor graders, or other like machines. The engine **50** associated with such machines, and with air intake system **100**, may comprise a diesel, gasoline, natural gas, and/or other like engine **50** known in the art. The disclosed precleaner system **200** can tune the airflow speed and provide peak air cleaner efficiency.

The precleaner system **200** can operate as follows: a gas flow stream containing particulate matter flows through the passage inlet **229***a*, **229***b*, **229***c* of each of the flow paths **224***a*, **224***b*, **224***c* in each of the precleaners **210***a*, **210***b*, **210***c*. The flow is induced to rotate within the flow paths **224***a*, **224***b*, **224***c*. The rotating nature of the flow stream causes centrifugal forces to act on the particulate matter in the gas flow stream. The particulate matter is heavier than the gas in the flow stream and migrates toward the wall of the passages **228***a*, **228***b*, **228***c*. The particles are ejected from the outlet ports **236***a*, **236***b*, **236***c*, while the remaining gas stream flows towards the passage outlets **230***a*, **230***b*, **230***c* and through the precleaner outlets **255***a*, **255***b*, **255***c*. The plenum **260** can be formed by the precleaner outlet walls **250***a*, **250***b*, **250***c* and the housing **205** and can collect the air flowing downstream from each of the precleaner outlets **255***a*, **255***b*, **255***c*. The precleaned gas stream flows from the plenum **260**, through the precleaner system outlet **280**, and can flow through the air passage **520**, towards the primary filter cartridge **510**. The particulate matter that is ejected from the outlet ports **236***a*, **236***b*, **236***c* falls by gravity downwardly into the ducts **215***a*, **215***b*, **215***c*. Ducts **215***a*, **215***b*, **215***c* funnel the particulate matter into the dust ejectors **240***a*, **240***b*, **240***c* where the particulate matter ejects from the precleaner system **200** via valves **245***a*, **245***b*, **245***c*. The valves **245***a*, **245***b*, **245***c* can be operable to allow for the flow of particulate matter to escape the precleaner system **200** by opening through direct pressure. The valves **245***a*, **245***b*, **245***c* can be operable to remain closed without the presence of direct pressure and prevent air from entering the precleaner system **200**. Clips **264** can be used to attach the precleaner intakes **220***a*, **220***b*, **220***c*, to the respective precleaners **210***a*, **210***b*, **210***c*.

A method for using the precleaner system **100** includes determining the intake airflow requirement of an engine dependent on environmental factors such as the composition, size, and amount of particulate matter to be removed from the intake air. The method further including tuning the intake airflow speed by blocking airflow through one or more of the precleaners.

Covers **270** can replace one or more of the precleaner intakes **220***a*, **220***b*, **220***c* and block air from passing through precleaner outlets **255***a*, **255***b*, **255***c* of one or more of the precleaners **210***a*, **210***b*, **210***c*. Alternatively, the covers **270** can be placed over one or more of the precleaner intakes **220***a*, **220***b*, **220***c* to block the flow paths **224***a*, **224***b*, **224***c* exposed to environmental air of one or more precleaners **210***a*, **210***b*, **210***c*. The covers **270** can be formed to attach to precleaners **210***a*, **210***b*, **210***c*, via the clips **274**. The covers **270** can be operable to tune airflow speed through the precleaner system **200** by blocking at least one of precleaner outlets **255***a*, **255***b*, **255***c* or the flow paths **224***a*, **224***b*, **224***c*. Using one or more covers **270** can allow for tuning of the airflow speed to remove the target amount of particulate matter from the air before entering the primary filter cartridge **510**. Alternatively the restricted airflow may be used to account for different engine **50** sizes.

Although this invention has been shown and described with respect to detailed embodiments thereof, it will be understood by those skilled in the art that various changes in

form and detail thereof may be made without departing from the spirit and scope of the claimed invention. Accordingly, the preceding detailed description is merely exemplary in nature and is not intended to limit the invention or the application and uses of the invention. In particular, the described embodiments are not limited to use in conjunction with a particular type of air intake system **100** or engine **50**. For example, the described embodiments may be applied to machines employed in mining, construction, farming, and power generation applications, or any variant thereof. Furthermore, there is no intention to be bound by any theory presented in any preceding section. It is also understood that the illustrations may include exaggerated dimensions and graphical representation to better illustrate the referenced items shown, and are not consider limiting unless expressly stated as such.

It will be understood that the benefits and advantages described above may relate to one embodiment or may relate to several embodiments. The embodiments are not limited to those that have any or all of the stated benefits and advantages.

What is claimed is:

1. A precleaner system for precleaning intake air for an air intake system, the precleaner system comprising:

a plurality of cyclonic precleaners, each precleaner including

a precleaner outlet wall, having a plurality of precleaner outlets extending through the precleaner outlet wall, each precleaner outlet in fluid communication with the intake air;

a housing extending between each precleaner and formed to position the plurality of precleaners in a predetermined relationship to each other;

a plenum formed by the housing and the precleaner outlet wall from each of the plurality of precleaners, the plenum in fluid communication with the plurality of precleaner outlets;

a system outlet in the shape of a hollow cylinder extending away from the housing and in fluid communication with the plenum;

a first cover formed to completely block intake air from passing through one of the plurality of precleaners; and

wherein each of the plurality of cyclonic precleaners further includes clips disposed proximate to the precleaner outlet wall and formed to connect each of the plurality of cyclonic precleaners to the housing.

2. The precleaner system of claim **1**, wherein the precleaner system further comprises a second cover formed to block intake air from passing through a plurality of precleaner outlets of at least one of the plurality of precleaners.

3. The precleaner system of claim **1**, wherein plurality of precleaners comprises at least three precleaners.

4. The precleaner system of claim **1**, wherein each precleaner further comprises a dust ejector having a valve.

5. The precleaner system of claim **4**, wherein the valve is a flap valve.

6. The precleaner system of claim **1**, wherein the each precleaner further comprises a flap valve.

7. A precleaner system to remove particulate matter from intake air for an air intake system, the precleaner system comprising:

a first cyclonic precleaner including

a first precleaner intake, having

a first intake wall, and

a plurality of first flow paths extending through the first intake wall, each flow path having a first outlet port disposed opposite from the first intake wall,

a first precleaner outlet wall having a plurality of first precleaner outlets extending through the first precleaner outlet wall and into the plurality of first flow paths, the plurality of first precleaner outlets in fluid communication with the plurality of first flow paths, and

a first dust ejector in fluid communication with each first outlet port, having a first valve disposed opposite from the first outlet port;

a second cyclonic precleaner having

a second precleaner intake, having

a second intake wall, and

a plurality of second flow paths extending through the second intake wall, each second flow path having a second outlet port disposed opposite from the second intake wall,

a second precleaner outlet wall having a plurality of second precleaner outlets extending through the second precleaner outlet wall and into the plurality of second flow paths, the plurality of second precleaner outlets in fluid communication with the plurality of second flow paths, and

a second dust ejector in fluid communication with each second outlet port having a second valve disposed opposite from the first outlet port;

a third cyclonic precleaner having

a third precleaner intake having

a third intake wall, and

third flow paths extending through the second intake wall, each having a third outlet port disposed opposite from the third intake wall,

a third precleaner outlet wall having a plurality of third precleaner outlets extending through the third precleaner outlet wall and into the plurality of second flow paths, the plurality of third precleaner outlets in fluid communication with the third flow path, and

a third dust ejector in fluid communication with each third outlet port and having a third valve disposed opposite from the second outlet port;

a housing extending between the first precleaner, second precleaner, and third precleaner, and formed to receive a portion of the first precleaner, the second precleaner, and the third precleaner;

a plenum in fluid communication with the plurality of first precleaner outlets, the plurality of second precleaner outlets, and the plurality of third precleaner outlets;

a precleaner system outlet disposed downstream of the plenum, in the shape of a hollow cylinder extending away from the plenum and in fluid communication with the plenum;

a first cover formed to completely block at least one of the plurality of first flow paths, the plurality of second flow paths, and the plurality of third flow paths; and

wherein the first precleaner, second precleaner, and third precleaner further comprise clips disposed proximate to the first intake wall, second intake wall, and third intake wall, the clips formed to connect the first intake wall, second intake wall, and third intake wall, to their respective first precleaner, second precleaner, and third precleaner.

8. The precleaner system of claim **7**, wherein the first valve, the second valve, and the third valve, each comprise a flap valve.

9. The precleaner system of claim 7, wherein the precleaner system further comprising a second cover formed to replace at least one of the first precleaner intake, the second precleaner intake, and third precleaner intake and block at least one of the plurality of first precleaner outlets, plurality of second precleaner outlets, and plurality of third intake outlets.

10. The precleaner system of claim 7, wherein the first cover includes a clip formed to connect to at least one of the first precleaner, second precleaner, and third precleaner.

11. A method for tuning intake airflow through the precleaner system of claim 7, the method comprising:

determining the intake airflow requirement of the engine; and

tuning the intake airflow speed with regards to a determined intake airflow requirement by completely blocking airflow through at least one of the plurality of precleaners.

12. The method of claim 11, wherein determining the intake airflow requirement of the engine is dependent on a size of particulate matter in the environmental air.

13. The method of claim 11, wherein determining the intake airflow requirement of the engine is dependent on a quantity of particulate matter in the environmental air.

14. The method of claim 11, wherein determining the intake airflow requirement of the engine is dependent on a composition of particulate matter in the environmental air.

15. The method of claim 11, wherein tuning the intake airflow speed with regards to a determined intake airflow requirement by blocking airflow through at least one of the plurality of precleaners includes blocking the plurality of precleaner outlets of at least one precleaner of the plurality of precleaners with a cover.

16. The method of claim 11, wherein tuning the intake airflow speed with regards to a determined intake airflow requirement by blocking airflow through at least one of the plurality of precleaners includes blocking the plurality of flow paths of at least one precleaner of the plurality of precleaners with a cover.

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